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☐ 1. Document ID: US 6503364 B1

L1: Entry 1 of 2 File: USPT Jan 7, 2003

US-PAT-NO: 6503364
DOCUMENT-IDENTIFIER: US 6503364 B1

TITLE: Plasma processing apparatus

DATE-ISSUED: January 7, 2003

INVENTOR-INFORMATION:

| NAME | CITY | STATE | ZIP CODE | COUNTRY |
|---|---|---|---|---|
| Masuda; Toshio | Toride | | | JP |
| Usui; Tatehito | Niihari | | | JP |
| Shirayone; Shigeru | Ebina | | | JP |
| Takahashi; Kazue | Kudamatsu | | | JP |
| Suehiro; Mitsuru | Kudamatsu | | | JP |

US-CL-CURRENT: 156/345.24; 118/712, 118/723MA, 118/723MR, 156/345.42, 156/345.46, 156/345.49

ABSTRACT:

In the plasma processing apparatus for generating plasma in a processing chamber and processing a wafer by mutual action of electromagnetic waves radiated from a UHF band antenna installed in the processing chamber and a magnetic field formed by a magnetic field generator installed around the processing chamber, a hollow tube having one end in communication with an opening in the side wall of the processing chamber and another end, outside the processing chamber, which has a measuring window of plasma optical emission. By setting the lines of force of the magnetic field formed by the magnetic field generator so as to form an angle relative to the hollow tube, entry of plasma into the hollow tube can be prevented, and adhesion of deposits onto the measuring window can be suppressed, whereby the transmission factor of the measuring window can be kept constant over a long period of use.

7 Claims, 6 Drawing figures
Exemplary Claim Number: 1
Number of Drawing Sheets: 4

Full | Title | Citation | Front | Review | Classification | Date | Reference | Claims | KWMC | Draw De

☐ 2. Document ID: US 6245190 B1

L1: Entry 2 of 2 File: USPT Jun 12, 2001

US-PAT-NO: 6245190
DOCUMENT-IDENTIFIER: US 6245190 B1

TITLE: Plasma processing system and plasma processing method

DATE-ISSUED: June 12, 2001

INVENTOR-INFORMATION:

| NAME | CITY | STATE | ZIP CODE | COUNTRY |
|---|---|---|---|---|
| Masuda; Toshio | Toride | | | JP |
| Mitani; Katsuhiko | Hikari | | | JP |
| Kaji; Tetsunori | Tokuyama | | | JP |
| Tanaka; Jun'ichi | Chiyoda-machi | | | JP |
| Watanabe; Katsuya | Kudamatsu | | | JP |
| Shirayone; Shigeru | Kudamatsu | | | JP |
| Otsubo; Toru | Fujisawa | | | JP |
| Sasaki; Ichiro | Yokohama | | | JP |
| Fukumoto; Hideshi | Hitachinaka | | | JP |
| Koizumi; Makoto | Naka-machi | | | JP |

US-CL-CURRENT: 156/345.46; 118/723MA, 118/723R

ABSTRACT:

A plasma processing apparatus and a method therefor which can achieve a preferred process rate, a fine pattern process capability, a selectivity and uniformity of processing at the same time compatibly for a large size wafer, which effects are achieved by controlling the plasma state and the dissociation state of etching gas through control of the electron resonance through application of a magnetic field thereto. A high frequency power at 20-300 MHz is applied across a pair of electrodes in a vacuum process chamber, and a magnetic field is formed parallel to the plane of the electrodes in the space between the electrodes. By controlling the intensity of the magnetic field in a range of 100 gauss or smaller, formation of electron cyclotron resonance and electron sheath resonance occurring from interaction between the electrical field and the magnetic field in the electrode sheath portion is controlled. Thereby, the plasma state, i.e., the electron density, electron energy distribution and dissociation state of the process gas in the plasma, can be controlled. The magnetic field is generated by a plurality of coils, an outer shield, and pendant yoke to form magnetic field parallel to the plane of the electrodes in the space between the upper and the bottom electrodes.

10 Claims, 50 Drawing figures
Exemplary Claim Number: 5
Number of Drawing Sheets: 34

| Term | Documents |
|---|---|
| "6503364" | 1 |
| 6503364S | 0 |
| "6245190" | 1 |
| 6245190S | 0 |
| ("6503364" OR "6245190").PN..USPT. | 2 |
| ((6503364 OR 6245190).PN. ).USPT. | 2 |

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